

What is claimed is:

1. A method for detecting a biochemical reactant comprising the steps of:

hybridizing a biochemical specimen with a nucleic acid probe on a biochip, the nucleic acid probe including a configuration of a loop structure and arrayed on one or more electrodes provided on a surface of a substrate or substrate analog or the nucleic acid probe with said configuration but further including a label modification added in advance; and

detecting/discriminating a complex of the nucleic acid probe and the biochemical specimen, forming a double chain, by means of at least one of electrical, magnetic and optical changes on the surface of the biochip.

2. A method for detecting a biochemical reactant comprising the steps of:

hybridizing a biochemical specimen with a nucleic acid probe on a biochip, the nucleic acid probe including a configuration of a loop structure and arrayed on one or more electrodes provided on a surface of a substrate or substrate analog or the nucleic acid probe with said configuration but further including a label modification added in advance;

modifying with a label either during or after hybridization one or both of the biochemical specimen and the probe nucleic acid forming a double chain; and

detecting/discriminating a complex of the probe nucleic acid and the biochemical specimen, forming a double chain, by means of at least one of electrical, magnetic and optical changes on the surface of the biochip.

3. A method for detecting a biochemical reactant comprising the steps of:

hybridizing a biochemical specimen modified in advance with a label with a nucleic acid probe on a biochip, the nucleic acid probe including a configuration of a loop structure and arrayed on one or two or more electrodes provided on a surface of a substrate or substrate analog or the nucleic acid probe with said configuration but further including a label modification added in advance; and

detecting/discriminating a complex of the probe nucleic acid and the biochemical specimen, forming a double chain, by means of at least one of electrical, magnetic and optical changes on the surface of the biochip.

4. A method for detecting a biochemical reactant comprising the steps of:

hybridizing a biochemical specimen modified in advance with a label with a nucleic acid probe on a biochip,

the nucleic acid probe including a configuration of a loop structure and arrayed on one or two or more electrodes provided on a surface of a substrate or substrate analog or the nucleic acid probe with said configuration but further including a label modification added in advance;

modifying with a label either during or after hybridization one or both of the biochemical specimen and the probe nucleic acid forming a double chain; and

detecting/discriminating a complex of the probe nucleic acid the biochemical specimen, forming a double chain, by means of at least one of electrical, magnetic and optical changes on the surface of the biochip.

5. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein the detection/discrimination step includes comparing results obtained from measuring at least one of electrical, magnetic and optical changes to the surface of the biochip before the hybridization operation as a standard with results of the biochip following each step.

6. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein the detection/discrimination step includes measuring, before and after the hybridization operation and/or before and after the label modification operation, at least one of electrical,

magnetic and optical changes to the surface of the biochip, and comparing these results.

7. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein the detection/discrimination step includes measuring, before the hybridization operation, at least one of electrical, magnetic and optical changes to the surface of a biochip having a plurality of electrodes, and relative amounts of the nucleic acid probe on each electrode are calculated in advance and used as a corrective reference for measured values after each step.

8. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein a pre-modification with a label of the nucleic acid probe or the biochemical specimen is a multi-stage modification of two or more stages in which a second label is added targeting a first label previously attached.

9. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein modifying the nucleic acid probe or the biochemical specimen with a label is a multi-stage modification in two or more stages in which a modification with a first label is followed by a modification with a second label targeting the first label.

10. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein the label is selected from among fine metal particles (including Si), magnetic particles, ceramic fine particles, fluorescent labels, fluorescent dyes, dyes, chemical colorants and semiconductors.

11. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein detecting/discriminating electrical changes on the surface of a biochip is at least one of changes in current values, voltage values or resistance values on a biochip or electrode, and changes in capacitance on the surface of a biochip.

12. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein detecting/discriminating as electrical and magnetic changes on the surface of a biochip comprises the steps of:

detecting/discriminating at least one of changes in current values, voltage values or resistance values on a biochip or electrode, and changes in capacitance on the surface of a biochip; and

magnetically detecting/discriminating a signal from a complex forming a double chain.

13. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein detecting/discriminating as electrical and optical changes on the surface of a biochip comprises the steps of:

detecting/discriminating at least one of changes in current values, voltage values or resistance values on a biochip or electrode and changes in capacitance on the surface of a biochip; and

optically detecting/discriminating a signal from a complex forming a double chain.

14. A method for detecting a biochemical reactant according to any one of Claims 1 through 4, wherein detecting/discriminating as electrical, magnetic and optical changes on the surface of a biochip comprises the steps of:

detecting/discriminating at least one of changes in current values, voltage values or resistance values on a biochip or electrode, and changes in capacitance on the surface of a biochip; and

magnetically and optically detecting/discriminating signals from a complex forming a double chain.

15. A biochip comprising:
a substrate or a substrate analog;

at least one electrode formed on a surface of the substrate or the substrate analog; and

a nucleic acid probe arrayed on said electrode, each nucleic acid probe having a loop structure.

16. A biochip comprising:

a substrate or a substrate analog;

at least one electrode formed on a surface of the substrate or the substrate analog; and

a nucleic acid probe arrayed on said electrode, wherein the arrayed nucleic acid probe has a loop structure in which a principal part that binds complementarily to the biochemical specimen is located on a substrate or substrate analog side.

17. A biochip comprising:

a substrate or a substrate analog;

at least one electrode formed on a surface of the substrate or the substrate analog; and

a nucleic acid probe arrayed on the surface of said electrode, wherein the arrayed nucleic acid probe has a loop structure in which a free end not fixed to a surface of the electrode or a site of the loop structure capable of being modified with a label is located on a substrate or substrate analog side.

18. A biochip comprising:

a substrate or a substrate analog;
at least one electrode formed on a surface of the substrate or the substrate analog; and
a nucleic acid probe arrayed on said electrode, wherein the arrayed nucleic acid probe has a loop structure in which a site modified with a first label which allows further modification with a second label is located on a substrate or substrate analog side.

19. A biochip comprising:
a substrate or a substrate analog;
at least one electrode formed on a surface of the substrate or the substrate analog; and
a nucleic acid probe arrayed on the surface of said electrode, wherein the arrayed nucleic acid probe has a loop structure in which a label previously attached is located on a substrate or substrate analog side.

20. A biochip according to Claim 18 or 19, wherein the label is selected from metal fine particles (including Si), magnetic particles, ceramic fine particles, fluorescent labels, fluorescent dyes, dyes, chemical colorants and semiconductors.

21. A biochip according to any one of Claims 15 through 19, wherein the substrate or substrate analog material is glass or semiconductor silicon.

22. A biochip according to any one of Claims 15 through 19, wherein the substrate or substrate analog is capable of being embedded in a separately prepared electrical circuit board.